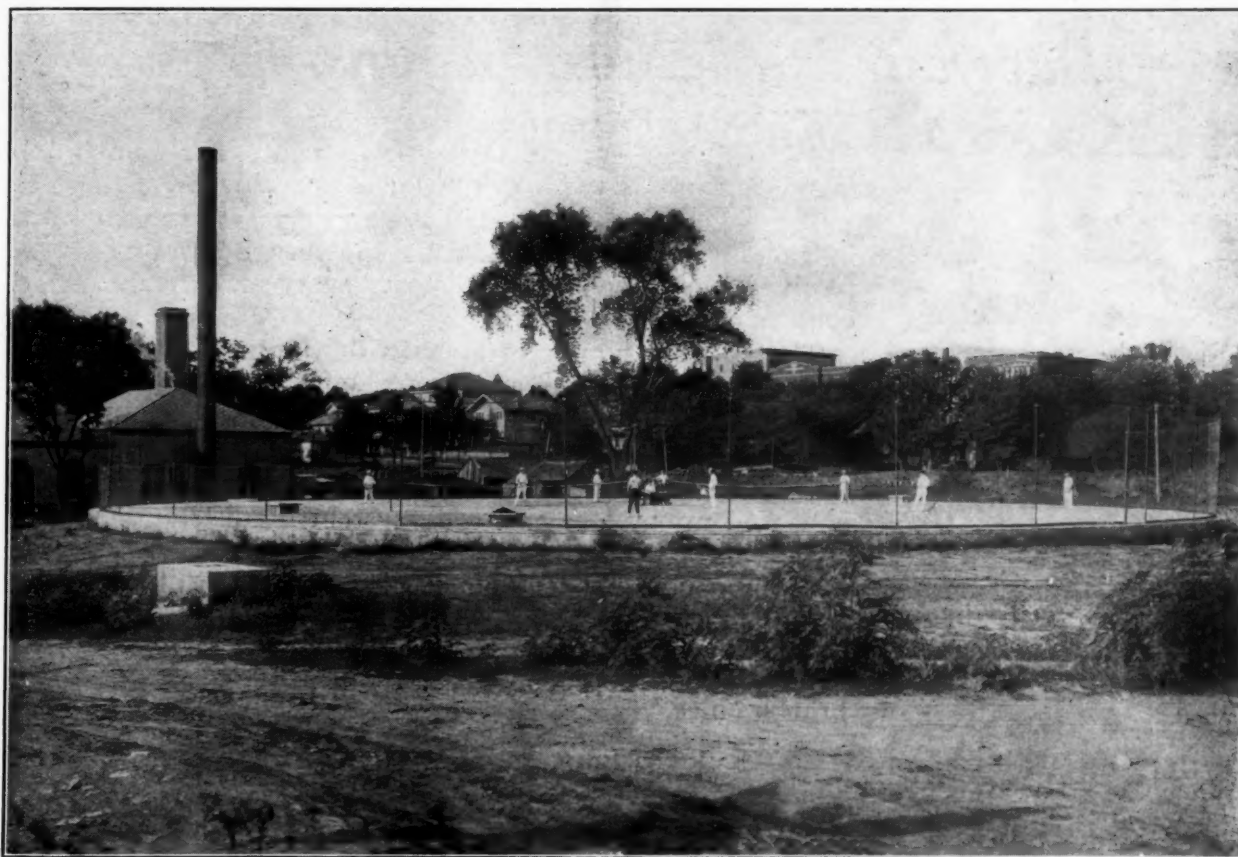


PUBLIC WORKS

CITY

COUNTY

STATE



ROOF OF RESERVOIR OF ARKANSAS CITY, KANSAS, USED FOR TENNIS COURTS.

This reservoir was described in the May 7 issue of "Public Works." The pumping station is seen at the left. The surrounding grounds are used by the city as a park and playgrounds.

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Inverted Siphons in Sewers
Relieving Unemployment in Construction Activities
Building Bridge Foundations in Deep Water

OCTOBER 29, 1921



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PUBLIC WORKS.

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OCTOBER 29, 1921

No. 18

Concrete Test Highway at Pittsburg, California

By Charles Geiger

Recently completed, with some new features for determining deflection under loads, elongation of reinforcement, effect of moisture on stability of adobe soil, and other points concerning which there are not any definite data.

A test highway has just been built at Pittsburg, California, which embodies several unusual features. It is an elliptically shaped roadway of plain and reinforced concrete, 18 feet in width, 1,371 feet in length on the center line and comprising 13 sections of pavement differing in design as well as in the quality and location of reinforcing.

The purpose of the test is to determine by observation under the same conditions of wear and on the same subgrade, the relative merits of different materials and cross-section design and at the same time to develop, if possible, an improved type of plain and reinforced concrete pavement. The conditions of the test are such and the participation of eminent engineers of such a nature that the results, it is believed, will be of the utmost value to state, county and city road and street builders.

The test highway was built on black adobe, and by means of side ditches into which water can be turned, each section will be flooded during the

tests and then dried out. Borings will be taken at regular intervals in the subgrade for soil samples (holes having been left in the concrete slab and filled up with wooden plugs for this purpose) to determine the moisture content of the soil. From observations taken in four tunnels which have been constructed under different sections, the relationship between the moisture content of the subgrade and its bearing power under traffic will be learned.

The tunnels have been constructed with their roofs a little over three feet below the top of the subgrade. These were constructed for the purpose of taking observations on the under side of slabs, to determine the effect of various truck loads and speeds on the flexure of the slabs as well as on the subgrade. Self-recording instruments are to be used in each tunnel which will indicate, directly, the flexure caused by loads on top of the pavement. These tunnels have been equipped with electric fans to keep them cool and well ventilated for the observers who will be stationed

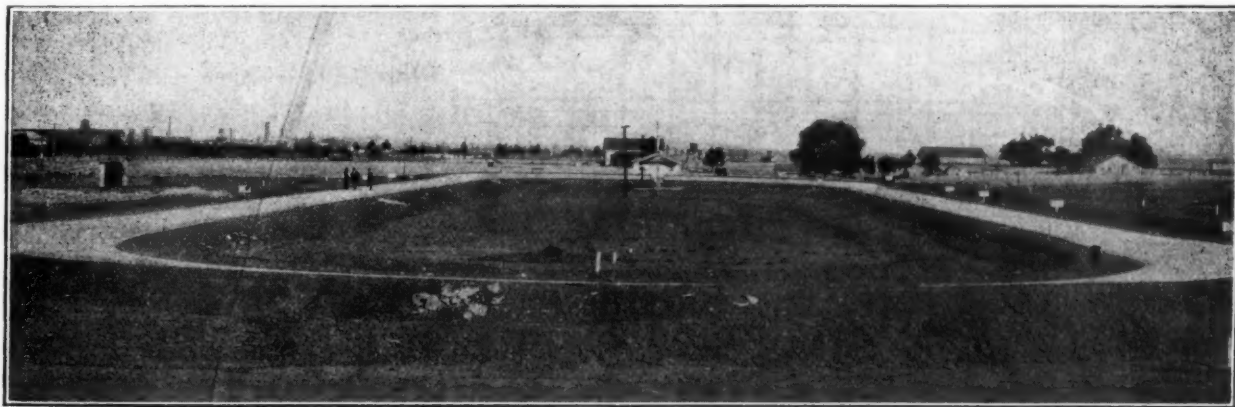


FIG. 1—TEST HIGHWAY, BUILT IN THE SHAPE OF A RACE TRACK

here. It is believed that this is the first time that provision has been made to make observations from the under side of slabs.

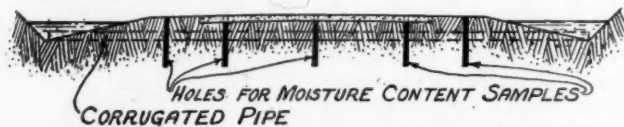


FIG. 2—CROSS SECTION OF ROAD SHOWING PROVISION FOR FLOODING

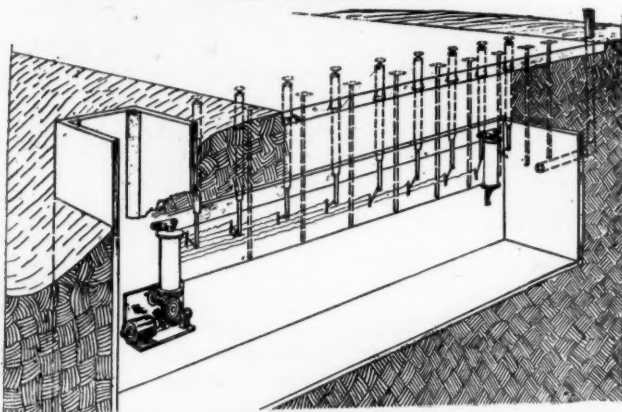


FIG. 3—SECTION OF TUNNEL, SHOWING APPARATUS INSTALLED IN TUNNEL

That adobe soils present most difficult problems for road building is recognized by highway engineers. Their characteristics of increasing or decreasing in volume as their moisture content becomes greater or less causes them to exert forces whose amount and direction of action are understood to only a very limited degree. It is well established that their power to support loads depreciates as the moisture content increases, but the law or rate of their depreciation is understood imperfectly. This quality induces a condition that causes the subgrade to be affected in an unusual manner by traffic forces. The amount of influence of the traffic on the adobe is tempered by the ability of the pavement to distribute forces over the subgrade or foundation.

The provisions shown in the cross-section Fig. 2 for flooding each section and then drying out, will permit making determinations that have been impossible in previous test roads.

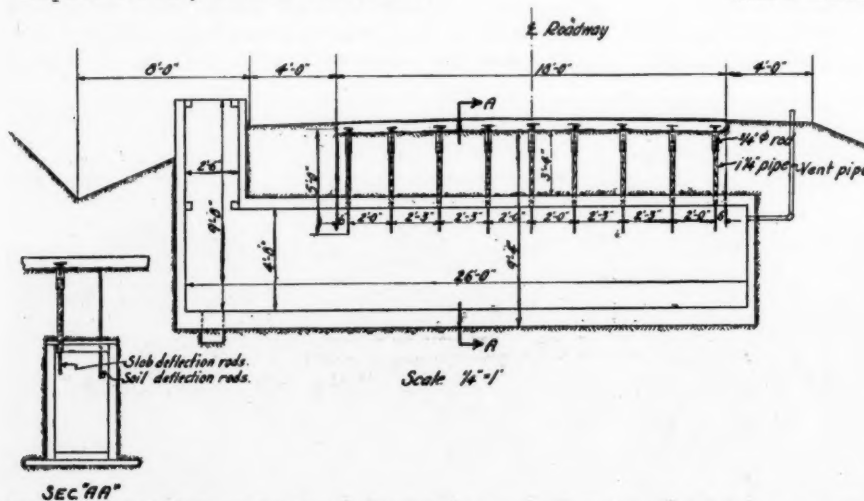


FIG. 4—SECTION THROUGH INSPECTION TUNNEL SHOWS DEFLECTION RODS EXTENDING THROUGH PIPE SLEEVES

In Figs. 1, 2 and 3 a number of rods $\frac{3}{4}$ inch in diameter and 5 feet in length have their upper ends imbedded in the concrete slab, and their lower ends extending down into the tunnel about 9 inches. In order to keep the water from entering the tunnels when the side ditches are flooded, as shown in Fig. No. 5 they pass through a pipe and a rubber hose. Both ends of the pipes are tapered and the lower ends extend down through the roof of the tunnel. To the upper ends are attached rubber hose about 12 inches in length. The upper end of the hose is embedded in the concrete slab about one inch. When a truck passes over the concrete slab, this arrangement permits the slab to sag, and at the same time keeps all water from the tunnel. Attached to the lower end of each rod is a self-recording pen. As the motor trucks pass over the concrete slab, these pens make a record on the record sheet,

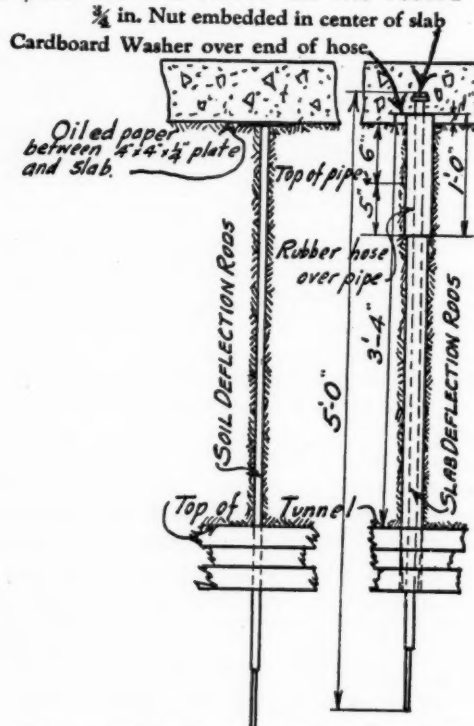


FIG. 5—DETAILS OF DEFLECTION RODS

which moves from one to four inches per minute, being driven by a small electric motor placed in the tunnel. These rods will record the flexure of the concrete slabs. Other rods, shown in the same illustrations, will record the flexure of subgrade. To the lower ends of the subgrade flexure rods will be attached verniers. Moving pictures will be made of the movements of the rods from time to time which will show the least movement of the rods.

A fleet of motor trucks will be run over the highway until the test road is tested to destruc-

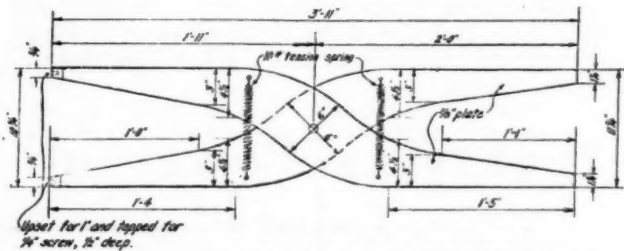


FIG. 6—FORKED EXTENSION FOR EXTENSOMETER

tion. Complete check of the results at all stages will be made so that at the conclusion of the test the results will be available in practical form and used to advantage in determining what types of construction are best adapted to California soil conditions.

The extensometer will also be used to measure the elongation of the bottom of the reinforced slabs, as the motor trucks pass over the section of pavement over the tunnels. This is the first time, it is believed, that the extensometer has been used for this purpose. In order to make this determination a steel device called an extension is used to transmit the movement of one of the reinforcing rods in the bottom of a slab to the extensometer, which will be operated from the main tunnel. A drawing of this extension is shown in Fig. 6. Holes 10 inches apart were drilled in the under side of one of the steel reinforcing rods and a thimble placed around the holes so that the concrete could not flow in when pouring the pavement. Two pointed pieces of steel, screwed into the ends of the extension were designed to fit into the two holes in the steel reinforcing rods. The extensometer will be applied at the opposite end of the extension. Readings will also be taken with this instrument on top of all slabs.

A complete system for making a record of all cracks as they appear has been worked out by marking the test road off into 6-foot squares, and as the cracks appear they will be plotted on a chart.

A novel method was employed in preparing the subgrade for section A, as shown in Fig. 7, where a loose rock fill was made on the subgrade. After the grade had been properly prepared, by scarifying, sprinkling and rolling, and before the header boards were placed in position, the middle portion of the grade was treated as follows: An excava-

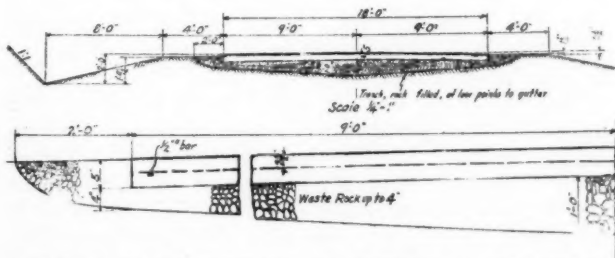


FIG. 7—HALF-SECTION OF SECTION A, SHOWING ROCK FOUNDATION

tion was made in that portion of the grade between the limits of 2 feet outside the lines for the header boards, or 11 feet either side of the center line. This excavation varied in depth from four inches at the edges to twelve inches in the center, brought to a surface of 2 inches below and parallel, and was filled with loose rock (oversize or waste rock) ranging in size from four inches on the bottom to one inch on the top. Care was taken to have the larger rock on the bottom, with many voids, to insure ample drainage. At various points trenches were dug to connect with the gutters, and the trenches filled with rock in the same manner. The rock fill was rolled by a three-wheeled road roller weighing ten tons and brought to a surface 2 inches below and parallel with the bottom of the pavement. Then loose dirt was spread over the rolled rock for a width of

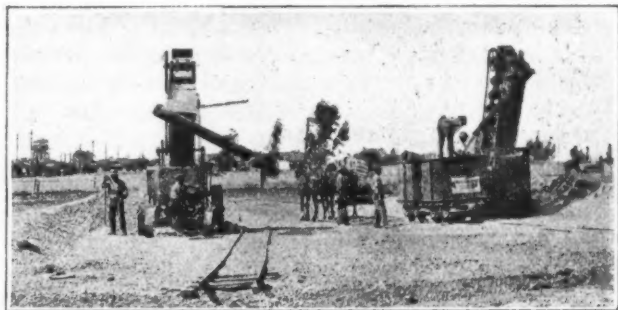


FIG. 8—LOADING BROKEN STONE AND SAND INTO BATCH BOXES, TWO TO A CAR THAT ARE HAULED ON RAILS ALONG SHOULDERS OF THE TEST ROAD

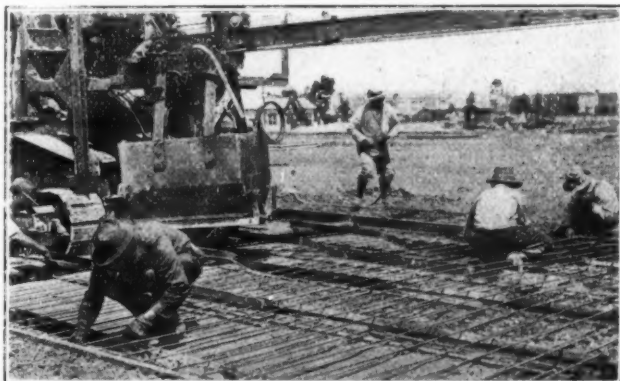


FIG. 9—USE OF CRADLE FOR PLACING REINFORCEMENT

9 feet either side of the center line, and rolled. Sufficient dirt was added so that it would be a little higher, when rolled, than theoretical subgrade elevation. The pavement was then laid on this subgrade.

One of the purposes of this test highway is to develop, if possible, an improved type of reinforced concrete pavement. In line with this purpose, two of the 13 sections that have been laid were reinforced with a special steel of very high tensile strength and provided with an extra bond to make the full strength available, which is expected to strengthen the slab more than would be feasible even with an excessive amount of commercial grade steel. This steel was developed expressly for road building purposes by the Columbia Steel Company of Pittsburgh, California,

which constructed the test pavement. In addition to the two sections in which the special steel was used, as many other designs as possible were sought from the state highway commission, county highway commissions, and individuals.

Many interested individuals and firms are co-operating in this test. Cement, sand and gravel for this test road were contributed by interested firms, equipment for the construction was loaned by manufacturers, a contractor undertook the work for the bare total of force account and expenses, all testing work is being done gratis by a San Francisco firm of testing engineers, trucks will be donated, and the cost of drivers and mechanics will be paid by the Motor Car Dealers' Association of San Francisco.

While the test is under way, sections of the road that give away first will be repaired so that the whole road will be usable until its last unit fails under the strain. This will afford a valuable opportunity to observe results of various types of repair work, a matter of particular interest as so many of the state highways are now undergoing reconstruction.

From 3,000 to 4,000 vehicles will pass over the road each day, the average weight of vehicle and load being about eight tons. A set of scales with a capacity of 50 tons has been installed for weighing the trucks taking part in the test.

Observations will be made of the results of this traffic and later, when some of the stronger sections fail to yield, War Department equipment will be used to complete the destruction.

In the construction of the test highway a novel method was employed to insure accurate placement of the steel reinforcing. This was done by means of a cradle, consisting of angle irons and pipes anchored to an 18-foot pipe 4 inches in diam-

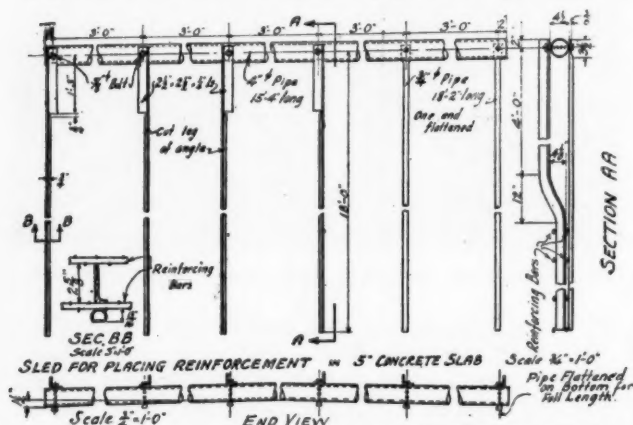


FIG. 10—SLED FOR PLACING REINFORCEMENT IN CONCRETE PAVEMENT

eter. This pipe was attached to the concrete mixer and served as a pull bar. As the concrete mixer moved forward the angle irons and pipes were pulled out, leaving the steel rods in place, and leaving very small voids in the concrete, which were filled by the adjacent concrete flowing into them.

The 13 sections vary from 150 feet to 45 feet in length, and from 5 to 8 inches in thickness. All are 18 feet wide. Only section A has the rock fill subgrade, the others all being laid directly on

adobe. Four sections are without reinforcement. In the other nine the reinforcement varies from 20 tons per mile to 69 tons. In three sections the reinforcement is placed diagonally. The four tunnels cross under sections B, D, G and I, having, respectively, 20, 55, 69 and 24 tons per mile of reinforcement.

Carrying Power of Odors

Difficulty of making mathematical measurements of intensity of odors or of describing their nature. Some instances cited.

Two or three years ago residents of the borough of Richmond, New York City, were very much wrought up by the location there of a garbage reduction plant for treating the garbage of three of the other boroughs of Greater New York and brought successful suit to prevent the operation of the plant on the plea that it was creating a nuisance. Active in the prosecution of this case was Louis L. Tribus, consulting engineer of New York City and residing in that borough and, probably as a result of his investigations at that time, together with the employment of his firm more recently in another nuisance case, he has collected considerable data on the matter of odors from such plants, which he has presented before the American Society of Civil Engineers under the title "Odors and Their Travel Habits," which paper is published in the August number of the proceedings of that society.

He calls attention to the fact that objections to odors may be sentimental rather than justified by actual nuisance, while on the other hand there may be a tolerance of them bred by acquaintance or induced by personal advantage.

One of the difficulties of dealing with the subject is the fact that mathematical measurement of odors is impossible. "One cannot say that a particular odor, given off at a specific heat, meeting a certain open air temperature at a certain barometric pressure and known degree of humidity, with a wind blowing just so many feet per second over a level plain, will be clearly noticeable at a computed distance from its source." Probably six simultaneous observers would not use the same adjective in describing any given odor, but if it is objectionable the adjective is inessential; the real point of importance is the distance that the odor travels. Since odors will travel, litigation will necessarily result and will have to be settled in some way.

Several instances of odors were cited by the author. The garbage reduction works at Barren Island (within the borough of Brooklyn, city of New York) for several years gave off fumes from the retorts and tankage dryers which traveled 5, 6, or more miles, according to wind and humidity, before diffusion and chemical break-up relieved the offense. "These odors, while disagreeable,

were not particularly nauseating to most people and for many years legal actions to end them were not effective. Recently, however, a permanent injunction has been granted. Close to the plant, although intensified, the odors were scarcely more offensive than at considerable distances."

An injunction having been granted against the operation of the Barren Island plant, one was located at the south end of Staten Island (borough of Richmond) to replace it. This new plant was supposed to be the latest word in garbage reduction and to avoid as far as possible the creation of odors or other nuisance. However, Mr. Tribus says that these works "for several months of operation prior to its being closed as a nuisance gave off gases that persisted in nauseating quality and strength to points 8 and 9 miles away. Rather curiously, although 24-hour operations were maintained, these peripatetic smells became more offensive after sundown. Evidently, the sun's rays possess a deodorizing power which was joyfully welcomed by the burdened population through those months of torment.

"Years ago it was discovered, practically by accident that sunlight streaming into a tank holding tried-out seal oil, while going through the curing process, killed in large measure the exceeding vile odors of decomposition, and these made life undurable for the workmen."

The state of New York for years maintained action against New Jersey to enjoin the emitting of corrosive gases and offensive odors from certain large manufacturing plants in Bayonne. Some of the defendants gathered some of the worst gases into two great chimneys, which they left at a height of 360 feet above the ground. "While the eye can see the output drifting for several miles, diffusion and perhaps transformation largely occurs before the odorous gases descend to ground level again, unless a strong wind blows them earthward to produce their old-time results of throat and nose irritation." Further north in New Jersey, odors given off in the preparation of certain chemical and other commercial products were intensely irritating to the residents of New York City more than a mile away across the Hudson river.

The author states that the peculiar and rather pungent odors of tropical vegetation in the West Indies can be discerned 25 or 30 miles before the islands are reached by boat but suggests that the ocean itself may transport the odors to a certain extent in the stream flow and land washings that it receives. This suggests that gases may be absorbed by water to be given off again some distance away, as, for instance, volatile elements from the effluents of sewage treatment plants seem to be carried in flowing streams for considerable distances. In such cases, however, the gases when liberated do not usually travel far from the stream itself. "Even in the case of the lower Passaic river, Gowanus creek and formerly the Chicago river, the well-known trio of unenviable waters charged to practical saturation with sewage, the odors were not noticeable usually for more than a few blocks away from their banks."

Mr. Tribus quotes a few brief sentences from the testimony of experts in the suit by Richmond borough to enjoin the operation of the plant before referred to, known as the Lakes Island reduction plant: "Odors travel greatly under light air and high humidity." "Garbage scow smells are noticeable from $\frac{1}{3}$ to $\frac{1}{2}$ mile." "Odors travel 3 to 5 miles, increasing with quantity . . . night travel is more offensive than day." "Odors carry, say, 3 miles." "Odors not so offensive with high winds." "Garbage odors will travel long distances." "Odors would not carry far."

Economical Blasting With T. N. T.

A new method for firing T. N. T. in propagated ditch blasting which greatly reduces labor costs and saves time has been evolved by the State Board of Health of Greenwood, Miss., in deepening the Walker's Lake canal. J. Lyell Clarke, sanitary engineer of the boards, says:

"Work on the canal was discontinued when attempt was made to fire T. N. T. in water by priming each charge with an electric cap connected in series—the usual method. Owing to the leakage of the electric current through water, this method proved a failure, caused misfires and resulted in a labor cost almost prohibitive.

"T. N. T. being very insensitive will not explode by the propagated method, so in an effort to reduce the two main items of cost of ditch blasting, which are labor and caps, a new method has been evolved. Tests were made wherein $\frac{1}{4}$ pound charges of 50 per cent straight dynamite were used in lieu of electric caps. Knowing that concussion from the explosion of one primed charge placed in the center of a line of charges of $\frac{1}{4}$ pound of dynamite, spaced at intervals of 18 inches, would be transmitted throughout the entire line and cause almost simultaneous combustion, it was thought that the explosion of the top charges of dynamite would in turn detonate the large charges of the more insensitive T. N. T. placed beneath it. This it did.

"The top charges of dynamite exploded the T. N. T. more completely than did the electric caps, shattered the top soil and lifted it well back, gave the T. N. T. an opportunity to heave out the bottom strata in good form and in addition thereby eliminated the cost of priming each hole, the cost of connecting the caps in series, and the cost of re-shooting misfires. Only one cap was required to set off one hundred charges. The resulting ditch was wider, larger and more uniform than that constructed with the T. N. T. detonated by an electric cap placed in each charge; besides, the work was speeded up about 200 per cent.

"The cost of blasting a ditch 10 feet wide at top, 3 feet wide at bottom and 4 feet deep, with charges $1\frac{1}{4}$ pounds of T. N. T. (or picric acid) detonated with $\frac{1}{4}$ pound charges of 50 per cent straight dynamite spaced 18 inches apart, is approximately \$750 per mile; or 14 cents per cubic yard of earth removed. Six laborers under average swamp conditions can blast one mile of ditch in one week."

Government Contracts

American Engineering Council would limit number of cost plus contracts, standardization of contracts, and prompt payments. Employment bureau for engineers.

After careful investigation and deliberation the executive board of the American Engineering Council has just recommended that:

"Whereas, the need is pressing for a unified employment service for engineers, national in scope, local in application, and financed for adequate service, and

"Whereas, the contributions which the constituent societies of the Federated American Engineering Societies are able to make to the Employment Bureau have been found inadequate to provide an employment service such as engineers require, therefore, be it

"Resolved: That the Executive Board of the American Engineering Council endorses in principle a paid employment service but in the reduced fees to members of organizations supporting said service, and be it further

"Resolved: That a committee of five members of the Executive Board be appointed by the chairman and that the Boards of Direction of the four founder societies be requested each to appoint a member of its board in order to form a joint committee of the nine members on engineering employment in the power to organize an employment bureau, on a plan which will invite the co-operation of interested organizations."

The question of government contracts was thoroughly discussed by the board which made important recommendations:

"That government work be normally carried out through unit price, or lump sum contracts, or by the purchase and hire method. Where none of the above methods are applicable to conditions, that the cost-plus method be used in which the contractor is refunded the actual cost of the work, plus an accorded compensation which increases if the work is done below the estimated cost of the work, and decreases if the work costs more than estimated, but never sinks below zero;

"That there be appointed by the president an Inter-Departmental Board on Standardization of Contracts, consisting of one representative of each government department engaged in construction. That this board recommend policies to govern in the standardization of contracts within each department. Each department should have a small board representative of each bureau engaged in construction, and should seek to unify and standardize contract practices within the department, and the chairman of these departmental boards might preferably constitute the inter-departmental board, which should be only advisory in character. That when the contracts of each department shall have been by itself thus standardized, that the Inter-Departmental Board

consider these contracts and make necessary recommendations to harmonize and secure, so far as feasible, uniformity of practice in the different departments;

"That all government officials shall recognize the importance of exerting the utmost efforts to take prompt partial payments on government contracts at reasonable intervals as stated in the contracts, for all services rendered and materials delivered by the contractor, on the work that has been accepted by the government inspector;

"That payment shall in all cases, as far as possible, be made by the official or agency directing the work, and not by an outside accounting or financial agency, in order to avoid the burden on the contractor of delays in payments when made by such agency not directly concerned with, or responsible for the efficiency, economy and dispatch of the work."

Relieving Unemployment By Construction Activities*

Vitality changed conditions, competition, United States co-operation, capacity to increase employment, freight, materials and financing are all important factors.

The rapid evolution in this country from an agricultural to an industrial nation and the change of the majority of the population from rural to urban dwellers and consequent dependence on continuous employment, have not so far been adequately provided for and now demand business co-ordination. An important factor of the present industrial condition and lack of employment is the development of trusts producing co-operation between producers, wholesalers and retailers in which the consumer gains little advantage.

We now face either a complete or a partial recognition of the co-operating principle of industrial business. Complete recognition involves a practical, economic revolution that would paralyze industry for a time and it is even doubtful if we are ready for co-operation in the production of the five great raw materials, namely: coal, iron, lumber, oil and copper, but we should not hesitate to take a step toward co-operative business organization. The question should be whether to reorganize one or more industry, preferably one, at the present time.

Unemployment may be mitigated, but not reduced, by [limited?] employment, providing a clearing house for laborers and work, and by reducing working hours or employing alternate shifts. The construction of public work in conjunction with other measures is advisable when assured of the co-operation of the public officials, industrial leaders and the public at large. The

Abstract of memorandum submitted to the President's Unemployment Conference by R. C. Marshall, Jr., General Manager of Associated General Contractors of America.

ability of public and private construction to aid unemployment is dependent one on the other, with the industries for construction market; on shortage and demand for construction; on capacity to increase employment; on causes delaying construction and steps necessary to revive construction.

Construction is the key to about 40 industries affording employment to greater numbers than construction itself. The potential demand for private and public work is estimated to be at present about \$15,000,000,000, including \$5,000,000,000 for home construction, \$5,000,000,000 for railroad construction, \$2,000,000,000 for public utilities, \$2,000,000,000 for public roads, \$1,000,000,000 for reclamation and irrigation, commerce and hydro-electric work.

The approximate ratio between the amount of labor employed in construction and in the six basic industries is estimated at about $2\frac{1}{2}$ to 1. The employment of 2 men in the field therefore means a total of 7 in the whole construction group. It is believed that if a large part of public work, for which appropriations are available is started in November, employment could be found for nearly 1 billion men within 90 days.

Construction has been delayed on account of the increased cost of labor, material, freight rates and financial charges. It is believed that the average cost of labor and material are now about 60 per cent greater than in 1914 and allowing a natural regular increase of about 20 per cent in that period they may be considered 40 points above normal at the present time. Any saving that might be effected by waiting for lower labor and material costs will be insignificant compared with the expense of any system of charity that might be necessitated by further postponement of work.

If construction is delayed until producers in the basic industries are driven out, the supply of materials will become so low that prices may move rapidly upward and we must therefore look beyond labor and material costs to reduce construction prices enough to stimulate the present demand.

Freight rates on construction materials are discouraging and sometimes even prohibitory. In some localities they are 129 per cent above the 1917 charges, amounting to as much as \$11,000 per mile for an 18-foot concrete highway, and unduly keep up the cost of construction and prevent its revival.

Interest, bonus, premiums and other financial charges on money loaned for construction purposes have been excessive, amounting in some cases to from $18\frac{1}{2}$ per cent to 30 per cent and causing many projects to be postponed or abandoned.

In order to give efficient government aid to construction it has been recommended that all federal, state, county and municipal work for which appropriations are available should be immediately put under construction; that necessary contemplated appropriations should be promptly made and that federal and state governments should co-operate on reclamation work; that a

home loan agencies should be established to furnish money at reasonable rates for housing construction; that freight rates should be adjusted on construction materials; that railway claims should be paid, enabling the companies to undertake improvements and extensions; that unlawful or injurious combinations and agreements in finance, building and material production should be investigated; that private construction should be encouraged by tax exemption; and that the Federal Power Commission be enabled to pass on private power prospects.

The paper concludes with the recognition of the danger of a very serious effect from the sudden expansion of construction materials prices when artificial stimulation is attempted. "Unless constructors, material producers and labor are willing in this emergency to accept reasonable profit and reasonable wages, any intensified construction program may end in disaster . . . since we should not attempt to arbitrarily regulate prices, assurance of reasonable prices must come from the far-sightedness of industrial leaders who know the ultimate benefit of steady prices, wages and market and from the force of public opinion. It is with these considerations in mind that stimulation of construction is recommended."

Road Resurfacing In Sullivan County

Unscarified macadam covered with two inches of water-bound macadam and three inches of bituminous macadam. Spraying sixteen feet width in one trip.

By W. A. Hardenburgh

Good management by the contractor and a somewhat unusual method of resurfacing are among the interesting points in a four-mile state road resurfacing job between the towns of White Lake and Monticello, Sullivan county, New York. The work is also interesting as showing what might be called standard road construction practice by the contractor, for the firm doing the work—De Graff & Hogeboom, Inc., of Kingston, N. Y.—has followed road construction for many years. A sample of the way the work was handled is shown by the fact that within ten minutes after the last stone had been crushed the work of dismantling the crusher was well under way.

In the resurfacing, the old road was neither cut down nor scarified. An "evenner" course of broken stone was laid on top of the old roadbed, and thoroughly rolled. On top of this was laid the new surface. This plan has the advantage of preserving intact the old road as a solid and well-compacted base, while saving labor in scarifying and reshaping.

The new surface, which was laid on top of the "evenner" course, consisted of two coats of bituminous material, totaling $2\frac{1}{4}$ gallons per square yard and 3 inches of crushed stone. The "evenner" course was of No. 3 stone, and of an average

thickness to give two inches of cover when well rolled. On top of this was placed 3 inches of No. 3 stone, which was thoroughly rolled. Bituminous material A of the state specifications was then applied at the rate of $1\frac{3}{4}$ gallons per square yard. The voids in this course were filled with a thin layer of No. 2 stone, which was rolled in. On top of this was spread $\frac{1}{2}$ gallon per square yard of bituminous material, and this was covered with a thin coat of No. 1 stone. The old road was of bituminous macadam 7 inches thick. The five inches of resurfacing gave the road a total thickness of 12 inches.

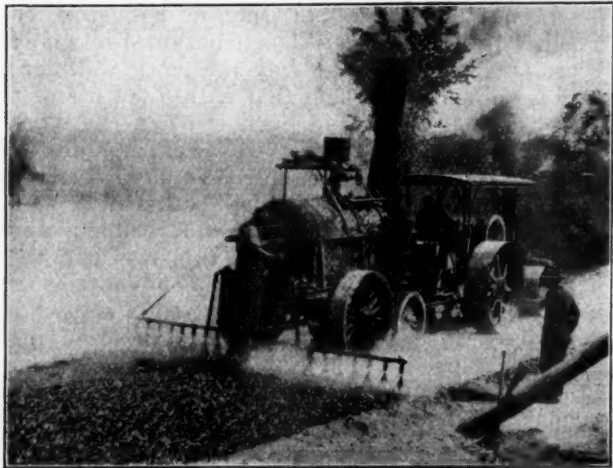
The contract also called for widening the road from 14 to 16 feet. One foot of width of standard bituminous macadam was added to each side of the old road, which had proved too narrow for traffic. Cleaning and reconstructing ditches and shoulders was also required by the contract.

Field stone, secured from stone walls, stone piles and the neighboring fields were used. Teams were employed entirely on the work of hauling stone from the field to the crusher, as on work of this sort a motor truck becomes mired or otherwise delayed frequently. A Climax crusher, steam engine driven, set up at a point about midway of the strip to be resurfaced, furnished the stone. No coarse stone were used, so tailings were recrushed.

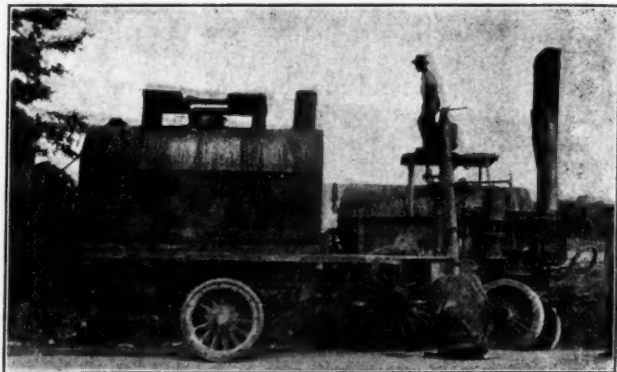
Except on the shortest of hauls, crushed stone was handled by motor trucks; on very short hauls teams were used. Two Brockway trucks, of 2 and $3\frac{1}{2}$ tons capacity, respectively, were used for hauling stone. These were equipped with solid tires, but were rarely used off the main road.

Spreading of the stone was entirely by hand, the men using stone forks. A Buffalo-Springfield 10-ton roller was used for compacting the broken stone. There was no appreciable amount of excavation; even the reshaping of shoulders and the reconstruction of ditches involved very little excavation. A Climax Jumbo road scraper was used on this part of the work.

The bituminous material for the road was



APPLYING BITUMINOUS MATERIAL TO ENTIRE WIDTH OF PAVEMENT AT ONCE



PUMPING OIL FROM MOTOR TRUCK TANK TO OIL SPREADER

hauled by a "King" motor tank truck from Monticello, about six miles away. The tank contents were transferred by hand pumping from the motor tank truck to the oil sprayer.

By means of extensions to the spraying bar, the entire width of the road was treated with bituminous material at one time, not only saving time, but also giving a more uniform application. The sprayer was hauled by the steam roller, which also furnished steam for heating the oil and for putting it under pressure.

Italian labor was employed mainly, the men being housed at a camp operated by the contractors. The average pay of the 50 men employed on the work was about \$3.50 per day each. The contractor also furnished his own teams and wagons—Eagle wagons were used.

The total cost of the four miles of resurfacing, along with ditch cleaning and reconstruction and remaking of the shoulders, was about \$57,000. Mr. Hogeboom was in charge for the contractors. A. L. Bush was engineer in charge of the work for the State Highway Department, and J. L. Scully resident engineer.

Sewage Disposal at Akron

Owing to the rapid growth of Akron during and since the war because of the enormous expansion of its industries, the sewage disposal plant completed a few years ago has already been greatly outgrown and can now treat only about half of the sewage. The other half is necessarily being discharged into the Cuyahoga river and this has been the cause of persistent complaint from the township below. It is expected that the state board of health will order the city to increase the capacity of its treatment plant so as to purify all of the sewage. The city engineers estimate that the cost of the addition to the plant will be approximately \$1,000,000. Plans have not been made for it yet and it is doubtful if construction will begin before next summer or fall even if the construction of the plant should be decided upon at once.

The present plant was built in 1915 and was described in "Municipal Journal" for July 15 and 22. At the same time and on the same site there was built a garbage reduction plant which was abandoned last year, hog feeding being substituted.

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S. W. HUME, President J. T. MORRIS, Treasurer
A. PRESCOTT FOLWELL, Editor
FRANK W. SKINNER, Associate Editor

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Psychology and Sewage Sludge Disposal

In a paper read before the American Society for Municipal Improvements this week and describing how the Rochester sewage disposal plant gets rid of its sludge, N. Adelbert Brown, the engineer in charge of the plant, makes statements that may suggest to other cities a means of inducing farmers to take sludge off their hands for use as a fertilizer.

It is a common remark that people seldom place much value on what they can get for nothing, and Rochester has applied this to sewage sludge. It was offered to near-by fruit growers and truck dargeners without charge, and some used it. But, says Mr. Brown: "Reports of the use of this fertilizer were not enthusiastic. This was, in part, due to a belief that enthusiastic reports would increase the price. In 1919 a charge of 50 cents a load was made, the buyer loading

from the dump, and more was drawn away than in the previous year with no charge." At the suggestion of the farmers, an additional 25 cents is charged when the sludge is discharged directly into their carts from a tippie. Up to July 1 of this year the city had received \$650 for sludge.

Possibly other cities might find that, by making it more convenient for the farmers to use the sludge, and by making a charge sumciently high to cause them to think that the city believes the sludge is worth something, the farmers would come to that opinion also.

The entire paper, which is very interesting, will be published in PUBLIC WORKS next week.

Maximum Speed Highway Construction

The description of a notable piece of highway construction and the accompanying editorial in our issue of October 15, abundantly demonstrate the possibility of securing maximum speed of construction in the early stages of a highway contract and the very great additional profit that may be secured by maintaining the maximum speed throughout practically the entire time of operation.

This desideratum is possible of attainment in nearly all contracts that are executed under ordinary conditions without unusual restrictions or physical difficulties. In general, the principal factors likely to expedite or retard the work are engineering, financing, traffic, organization, equipment, materials, schedule, stimulus and interference. Items which have different relative importance on different occasions.

Engineering promotes the rapidity and economy of work when the surveys, designs and specifications, detail plans and blue prints are all complete in advance of the work, and line and grade and special instructions are always ready for the contractor as soon as he needs them.

Financing is satisfactory when the contractor has acceptable surety bonds ready and sufficient resources and cash balance to buy all materials and equipment in ample time to avoid possibilities of delay and to meet the largest possible payrolls, freight charges, and incidental expenses promptly and without difficulty.

The season should be selected so as to allow the work to be commenced and continuously prosecuted under the most favorable weather conditions, when the soil is in good order and delay from flood or storm or interruptions by rain or inclement weather are minimum.

Ample provision should be authorized and carried out in advance for the suspension or by-passing of traffic or, if it must be maintained along the line, for its regulation so as to involve no delay or obstruction to the construction.

The contractor's office and field organization should be complete, with energetic, skilled and thoroughly reliable men in charge of all the different departments, with selected labor trained to do specific or routine work to the best advantage, and with thorough co-ordination throughout, preventing all interference, duplication of

work, or lost time. Each man should know in advance what he is to do, how to do it and when to do it.

The equipment should be of standard type of the highest efficiency, simple in design and abundant to keep the entire labor force always busy and to eliminate labor, save time, and secure continuity of work to the utmost degree.

Arrangements should be made in advance for the testing and acceptance of satisfactory materials of all kinds and for their delivery, storage and distribution in a way most advantageous for rapid work and to prevent delay, and loss or damage to the materials.

A complete schedule should be prepared in advance showing the exact time and duration of every operation, the labor, materials and equipment required for it and noted on a chart, and should be kept displayed and posted daily so that the exact condition of the work may be instantly apparent by inspection.

The men may be stimulated to greater speed and efficiency by several methods or a combina-

tion of them. All of them, or certain groups, may be promised a bonus for the completion of the job or a section of it in a given time. They may be given a certain quantity to perform for which a full day's wage will be paid no matter how quickly it is done. They may be paid on the piece-work plan at a certain rate per unit of work accomplished; and competition may be secured by establishing a rivalry between gangs or sections to be either given prizes or honorary badges for first completing their given amount of work.

Delays and reduced speed are sometimes due to disagreements or quarrels with local authorities or residents, or infringement of local ordinances, which should be avoided; or to waiting for permits to close streets or move sewers, water pipes or telegraph lines, all of which should be provided in advance.

A systematic inspection of all equipment and tools and prompt repairs of any damages or renewals of broken equipment are important and should be fully provided for by the supply and repair department.

Inverted Siphons for Sewers

The Boston Society of Civil Engineers in February, 1915, appointed a committee on Inverted Siphons for Sewers, consisting of W. S. Johnson, R. M. Whittet and Prof. Dwight Porter, with instructions to study and report upon methods of design and construction and results of operation of inverted siphons, both those for carrying sewage only and those for storm water. Shortly thereafter a questionnaire was sent out to New England cities and more or less complete information was secured concerning upwards of 90 siphons. Based upon this and upon material found in various engineering publications the number was later increased to 140 siphons.

A discussion of these data was held in April, 1916, by the sanitary section of the society and more data obtained. Unfortunately the chairman, Mr. Johnson, died in October, 1917, and Mr. Whittet, who succeeded him as chairman, died in December, 1918. Apparently the chairmen of this committee, as is the more or less common practice, performed most of the work, and neither had concluded the summarizing of the information. The third member, Prof. Porter, succeeded as chairman and F. A. Marston and H. E. Holmes were added to the committee. The committee thus constituted was unable to learn what progress, if any, either of the previous chairmen had made with the report and considerable of the data obtained could not be found. However, the questionnaires were in the possession of the committee and on the basis of these a report has been prepared and was presented to the society under date of July 16th, 1921.

This report contains a general discussion of the engineering principles involved in inverted siphons with numerous illustrations of the different points drawn from actual practice; a tabulation of the data obtained through the questionnaire and detailed descriptions of a number of inverted siphons both in Massachusetts and elsewhere. An effort is made below to present in as condensed form as possible some of the more valuable features of this report, omitting to a large extent the discussion of fundamental principles, which can be found in text books such as Folwell's "Sewerage," Metcalf & Eddy's "American Sewerage Practice," etc.

Apparently the earliest inverted siphon in this country was one built under Dorchester bay and completed in 1883. In addition to being the oldest it is also conspicuously the longest, largest and deepest inverted siphon in Massachusetts,

being 7,160 feet long, 7.5 feet inside diameter and averages 142 feet below low tide. Quite recently a considerably larger one has been built to convey the sewage of New Orleans under the Industrial canal, this being 10 feet in diameter with a nominal carrying capacity of 2,000 cubic feet per second.

Most inverted siphons are under pressure and are generally built of iron or steel, although in some cases vitrified pipe is used, generally reinforced with concrete.

Inverted siphons are used where the hydraulic gradient of a sewer line lies above the bottom of a stream or valley crossed, and also where it would pass through another conduit, subway or other underground structure. A notable illustration of inverted siphons under subways is furnished by New York City, where 20 siphons were necessitated by the construction of the subway, these varying in diameter from a pair of 101-inch pipes to one 16-inch pipe for storm water, and for house sewage from one 6-inch pipe to one 42-inch. Most of the New York siphons are comparatively short, varying in length from 66 feet to 256. The depressions below grade vary from 2.3 feet to 22.0, most of them running between 10 feet and 15 feet. The first New York siphon was built in 110th street in 1913 for carrying a 10-foot by 12-foot sewer under the Lexington avenue subway. Two authorities on sewer construction advised against it, but it was built and has given no trouble. This and another siphon could have been avoided by lowering the subway for eight city blocks or by building a new trunk sewer, but the former would have cost about \$1,000,000 and unfavorably affected the location of stations. The new trunk sewer would have cost \$1,500,000, while the two siphons cost about \$71,000.

There appear to have been few data for checking up the theoretical calculations as to loss of head, velocity, etc., in inverted siphons, but experiments made by the Massachusetts State Board of Health on the Gardner inverted siphon built in 1890 showed actual losses of head, after flushing, varying under two different heads of flow from about 1.9 to about 2.2 times the loss computed for a clean pipe; while seven months later, without again flushing, the loss of head was roughly 3.5 times that computed for a clean pipe. This was a 12-inch iron pipe 1,050 feet long. Under an average velocity of about 0.4 feet per second, flushing had not yet been thought necessary for several years.

Velocities in five Boston inverted siphons were found to vary from 1.19 to 3.49 feet per second. It has generally been assumed that siphons should be so designed and operated as to secure a velocity of at least two or three feet per second, but experience with these and other siphons seems to indicate that lower velocities than these have been maintained for years without causing serious deposits or other troubles. Actual velocities, however, may be increased by deposits in the siphons, as is described further on.

Concerning the profile of an inverted siphon, the committee reports that "where the water carries heavy matter in suspension or rolled along the sewer bottom, as in the case of storm flow, an upward slope at the downstream end is more favorable than a vertical rise for carrying the grit out of the siphon. In cases where there is but scanty head available and its conservation is important for avoiding back water upstream, inclines at the ends involve somewhat less loss of head than vertical wells. Inclines are a feature of all the inverted siphons used on the combined sewers intersected by the New York City subways, with the exception of that at Hudson avenue, Brooklyn."

Screens above siphons are not generally introduced and the advisability of them is to be questioned. "During the construction of the Brooklyn inverted siphon made necessary for subway work, the use of bar screens above siphon entrances to keep out large floating materials was considered, and to test its practicability a temporary wooden screen was set up in a large sewer leading to one of the siphons. Within two days it was completely covered for the depth of the flow with rags, paper, twine, wood and other debris, effectively blocking the flow and showing conclusively that any such device would form a dam in a very short time." (See "Municipal Journal" for April 26, 1917.)

There appears to be wide difference of practice regarding the employment of sumps at the upper ends of inverted siphons to catch silt and other heavy matter. Of the siphons for which returns were received, sumps were provided on 16, at the upstream end, on 32 at the downstream end, on 17 at both ends, and on 58 at neither end. The first inverted siphon built in New York because of subway construction had a sump at the upstream end, but after seven years of experience with it the engineers considered it unnecessary

and recommended omitting sumps from subsequent designs. Instead of a sump, an inverted siphon in Fitchburg, Mass., had placed above it a grit chamber 50 feet long, and the Dorchester bay siphon referred to has a settling chamber in the form of twin "deposit sewers" 1,260 feet long in which the velocity does not exceed one foot per second.

CLEANING INVERTED SIPHONS

For cleaning inverted siphons, both flushing and hand work are employed. For flushing the methods in use are stated by the committee to be as follows: (a) The temporary speeding up of pumps, if there is a pumping station on the sewer line. (b) Receiving the sewage flow at the head of the inverted siphon into flush tanks which automatically discharge when full. (c) Providing a permanent flushing gate at the manhole at the head of the inverted siphon, or else grooves for the insertion of stop planks when desired. (d) Opening a blow-off at the low point of the pressure pipe of the inverted siphon. (e) Admitting clean water at the head of the inverted siphon from a permanent connection made with a street water main or through a hose line from a neighboring hydrant. (f) Introducing river water through a special connection to the chamber at the head of the siphon, which is occasionally possible.

As illustrations of the above methods, method (a) was used in the Dorchester bay inverted siphon. In connection with this, the value of C in the Chezy formula was determined both before and after flushing, using the pumps as meters, and this co-efficient was found to increase from about 80 before flushing to between 140 and 150 after flushing. Increased velocity for flushing was obtained by proper manipulation of the pumping units, admitting sea water to the pump wells when there was not enough sewage and storm water.

Method (b) was used at Concord, Mass., where there was installed a flush tank at the head of each of two 8-inch siphons, one with a capacity of 7,400 gallons and the other 1,570 gallons, the tanks discharging from 10 to 14 times a day.

Method (c) was employed in the siphon of the metropolitan main sewer at Portland and Main streets, Cambridge, and on four siphons on New Bedford.

Method (d) was used for a 30-inch inverted siphon 5,300 feet long at Fitchburg, which drops 52 feet from its upper end to the lowest point in the Nashua river, where there is provided a 24-inch blow-off discharging into the river. At Gardner and at Andover there are blow-offs at the low points discharging onto small filter beds; the former being a 12-inch iron pipe 1,050 feet long with a 25-foot drop and the latter a 12-inch pipe 4,980 feet long with a 66-foot drop.

Method (e) is employed in connection with the Andover siphon just referred to, which is connected with a 6-inch water main. This method is also used for the inverted siphons under the subways in New York City wherever the dry-weather pipe has at times too small a flow to prevent deposits.

(To be continued)

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Small Bridge Foundations in Deep Water

When the foundations for small bridge piers are built in water more than 5 or 10 feet deep the construction of submerged concrete or masonry is likely to be more difficult and expensive than where the water is shallower, but unless the current is very swift or there is a very irregular hard bottom the work can usually be done with moderate rapidity and economy when the designs and specifications are properly adapted to the conditions, and even provided they are not, or unexpected conditions develop, good results may often be obtained if the engineers will accept alternative features of design, suited to practical and economical methods of construction, which the contractor may often be in a position to propose.

If the water exceeds 15 or 20 feet in depth or the current is more than 4 miles per hour, or the site is exposed to frequent and violent storms or the bottom is very difficult, thorough examinations should be made by the contractor before his bid is prepared and he should retain the consulting or supervising services of an engineer experienced in this class of work.

If difficulty is anticipated in carrying out the work according to plans and specifications, very careful study should be given to them and to local conditions with a view of preparing alternate plans and working out standard, modified or special methods of construction to save time, danger and expense. If such methods are found and well presented and the contractor has sufficient equipment and capable men to execute and direct the work it is probable that such changes, if not inimical to the quality of the finished structure will be acceptable to the engineer and owner.

FOUNDATIONS ON HARD BOTTOM

If the bottom is approximately level rock, watertight sectional forms may be sunk to exact required position with their upper edges above water level and a few feet of concrete may be deposited in them under water by bottom dumping buckets or tremies, sealing the form which then acts as a cofferdam and may be pumped out and the remainder of the concrete deposited in the dry.

If the rock bottom is irregular, small cavities may be filled or sloping surfaces built up, by concrete bags deposited by divers around a template

to form a support for the lower edges of the form which can then be sunk and concreted, as described above. If the surface of the bottom is generally level, local projections and irregularities are desirable rather than objectionable if they are of sound, hard material and clear the forms. If the bottom is covered with mud, silt or sand it can be removed by dredging, scraping, or by powerful suction pumps aided perhaps by hydraulic jets or by combinations of them. Some of these methods may be employed to remove irregularities and projections of hard strata not solid rock.

After the forms are concreted the detachable sides should be removed and if necessary used over and over again for other piers. If the current is swift, or if wave action has to be resisted, it may be desirable to build timber cribs sunk with rock ballast and having interior pockets for concrete to be deposited under water and form footings, sealing if necessary to lower ends of forms or cofferdams similar to these that have been described.

FLOATING CAISSONS

If the depositing of concrete under water is prohibited or undesirable it may sometimes be placed in a floating caisson, which consists virtually of a sectional, detachable cofferdam large enough to enclose the pier and connected to a permanent detachable bottom, caulked watertight, floated to position and moored over the required center after the river bottom there has been properly leveled by divers or by dredge or scraper work, provided it is of satisfactory hard and sound material.

If the bottom is not too soft to carry the load wooden piles may be driven in it and capped with concrete placed under water or cut off to exact level by a submerged circular saw, or the piles, carefully driven to approximate position, may be left uncut and their tops enclosed in a carefully leveled mass of concrete, thus forming a footing with horizontal surface to receive the bottom of the caisson which is gradually sunk to rest on it by building the concrete pier within. The bottom of the caisson may be either of concrete or of timber, remaining in position after the sides are detached and removed. If of concrete, it should be reinforced like a floor slab, to resist unbalanced upward pressure. It may have short side walls connected by transverse partitions, all forming stiffening webs. Rubber gaskets or their equivalents should be provided in the joints of the detachable sides.

COFFERDAMS

If the rock bottom is covered with several feet of mud, clay or solid earth there may be built on it a cofferdam, consisting of a single line of interlocking steel sheet piles assembled to form a complete enclosure around the pier before driving is commenced, and then driven successively a foot or two each by an air hammer or steam hammer moving around and around the cofferdam until all are driven to the required depth.

Under ordinarily favorable conditions such a small cofferdam can be readily pumped out with one or two 4 or 6-inch centrifugal pumps that will also take care of ordinary leakage through the sides, the latter generally diminishing as the narrow openings of the installation joints become filled with mud and silt, a process which can be accelerated by throwing in sand, manure and similar material on the outside where it will be drawn in by the flow of the water. The cofferdam can be thus unwatered and the bottom excavated to a point not below the lower ends of the piles, after which the forms can be placed and the concrete deposited in the usual manner, and the piles pulled and redriven for other cofferdams or stored or sold.

Steel sheet piles of various sizes weighing from 5 to 50 pounds per square foot have been designed and manufactured for this sort of service and some of them provide for very wide units of minimum weight and cost to be used in soft material while others are intended for hard driving and will endure great abuse. The ordinary weight is from 20 to 45 pounds per square foot and the cost is generally slightly greater than that of structural steel. Under favorable circumstances from 50 to 100 sheet piles can be driven per day with a small steam or air hammer. They are driven much faster with double-acting steam hammers that also can be adapted to pull the piles.

CYLINDER PIERS

Small bridge piers have often been made with a pair of riveted steel cylinders from 4 to 10 feet in diameter, sunk to the required depth, filled with concrete and braced together above the bottom of the river. Sometimes these cylinders are sunk above a small cluster of previously driven piles and sometimes the cylinders are first sunk and the piles afterwards driven in them with followers. The cylinders are usually made of thin steel plates and are sunk by loading and interior excavation; having the upper courses bolted or riveted on as they sink. The cylinder sinking may also be facilitated by a hydraulic jet played around the lower edge, if one is available.

The interior may be excavated by any convenient method such as the suction pump or an excavating bucket or even by hand if the water can be pumped out. When the cylinder is sunk to the required depth if the bottom is sufficiently sealed by stratum which it penetrates, the water can be pumped out and the cylinder filled with concrete placed in the open air, but if it is impossible to at first unwater the cylinder, a foot of concrete may be deposited under water to seal it, after which it is pumped out and the remainder of the concrete placed in the dry.

If riveted steel cylinders are not available, wooden cylinders made with staves banded together, may be used instead, but should be shod with steel or iron to form a cutting edge.

IMPROVISED PILE DRIVER

When wooden piles are required for foundations in inaccessible places where it is difficult or expensive to secure and operate regular pile driver machines, it is often possible to drive the piles in soft ground, not clay, by means of a hydraulic jet of 100 to 200 pounds pressure, delivered through the nozzle attached to a long 2-inch steel pipe with flexible supply connection, that may first be used to dig a hole for the pile, and afterwards loosely attached to the pile and carried down with it while the sinking is assisted by blows on the pile top from a battering ram, or any conveniently improvised hammer.

A serviceable hammer can be made from a short round log of heavy green timber which should run up and down between vertical guides, called "leads," that can be rigidly attached to, or pivoted on, a fixed or movable framework or tower or can be suspended from a derrick boom and held by hand lines or guys. A very light and portable arrangement consists of a vertical mast seated on and braced to a T-shaped horizontal sill frame. A-frames, tripods, breast frames and gantries of various kinds on sliding sills or on wheels or rollers may also be used to support the hammer and leads.

Co-ordinating the World's Production and Construction

A special committee on construction, Noble Foster Hoggson, New York, chairman, appointed pursuant to the action of the board of directors of the International Chamber of Commerce to study the construction industry, referred the results of their study to the production group for examination and decision as to practical measures which should be taken in order that the International Chamber of Commerce may most effectively take action in the matter and the production group has recommended that the board of directors take the following steps:

A. Appoint a permanent committee to undertake a survey of the construction industry which shall proceed along the lines of collecting and collating and disseminating the vast amount of valuable data which is available and which is at present in the possession of such agencies as the British Societies of Engineering Standards, the Royal Institute of British Architects, the French Ministry of Commerce, the Office de Batiment in Paris, the International Biographical Institute of Brussels, the Advisory Committee of the Federation of Labor, the National Federation of Construction Industries of the United States, the Associated General Contractors of America, and a number of similar agencies operating in different countries.

B. Subject to the availability of funds which can be used for the purpose, provide a necessary staff for carrying on the work above described.

Recent Legal Decisions

SIDEWALKS AND CROSSINGS NOT REQUIRED TO BE PERFECT

The Wisconsin Supreme Court holds, *Hollan v. City of Milwaukee*, 182 N. W. 978, that many circumstances, such as the topography of the locality, the development of the community, the standard of road construction attained therein, the amount and character of traffic, etc., are to be taken into consideration in determining whether a given condition renders a highway defective. What will render one highway defective will not condemn another. This rule applies to sidewalks in cities as well as country highways. It was held that a slope of seven inches in a cement walk approaching the flagstone part of the walk in an alley in a residential district, on which the plaintiff slipped and fell, was not such a defect as to make the city liable for the plaintiff's injuries. Nor was the fact that one of the cobblestones at the crossing projected above the others from 1½ to 2 inches such a defect. The court said: "When cobblestones are used in the construction of alleys or portions of walks, there will necessarily be more variation from a level surface than when brick or cement is used. In planning for the construction of walks over alleys and streets where there are inequalities in the surface, municipal officers may assume that pedestrians will use some care and will seek to avoid dangers which are obvious." Walks and crosswalks are not required to be perfect. It suffices if they are reasonably safe. There may be inequalities, projections, and depressions so slight that municipal authorities may assume that they will not cause injury to persons using ordinary care.

CONTRACTS BETWEEN MUNICIPALITIES AND PUBLIC UTILITIES UNDER OHIO CONSTITUTION

The Ohio Supreme Court holds, *Link v. Public Utilities Commission*, 131 N. E. 796, that section 4, art. XVIII of the Ohio Constitution is self-executing and no action of the legislature is essential to empower a municipality and a public utility corporation to enter into a valid contract for the product or service of such corporation to be supplied to the municipality and its inhabitants. Such a contract is not subject to review by the Public Utilities Commission.

HOLDER OF PAVING WARRANTS NOT ENTITLED TO PENALTY ON DELINQUENT TAXES

A corporation, holder of certain paving warrants, regularly issued by officers of Oklahoma City against lots benefited by paving, and regularly certified by the city treasurer to the county treasurer with the city taxes, brought an action against the county for interest purported to have been collected by the county treasurer and not paid to the bondholder. The evidence conclusively disclosed that the amount of the warrants and all interest collected thereon was paid to the bondholders, but the taxes were not paid when due and became delinquent, and the county treasurer, when collecting the taxes, added the penalty of 18 per cent, as provided by law. The

Oklahoma Supreme Court holds, *Board of Commissioners of Oklahoma County v. Close Bros.*, 198 Pac. 845, that the owner of said warrants is not entitled to any portion of the penalty collected by the county, to supply a deficiency for interest not collected, and it was error for the trial court to render judgment against the county for said warrants.

COUNTY NOT LIABLE FOR DAMAGE CAUSED BY THE SPARKS FROM ROAD BUILDING ENGINE IN ABSENCE OF LEGISLATION

A county is a political subdivision of the state, and as such is not liable to suit, unless there is a law which in terms or by implication so declares. Applying this principle, the Georgia Court of Appeals holds, *Mills v. Chatham County*, 107 N. E. 628, that a petition alleging that defendant county, by the negligence of its servants in the operation of an engine in the course of duly authorized public road building, sparks were emitted by the engine, which set fire to and burned the plaintiff's house, was subject to general demurrer. Without further legislation, it was held there could be no recovery for the damages occasioned by the alleged negligence of the county's servants. A wrong had been done the plaintiff for which the law provided no remedy.

DUTY OF CITY TO GUARD DANGEROUS EXCAVATIONS THOUGH IMPROVEMENT WORK IS DONE BY CONTRACTOR

The Indiana Appellate Court holds, *City of Indianapolis v. Cox*, 132 N. E. 8, that if a city and its contractors and subcontractors engage in improving a street where the work contemplated involves grading and filling in such a manner as to render the street unsafe for travel, it is the duty of all three parties, including the city, to see that such dangerous places are properly safeguarded by barricades, lights, and other signal devices, unless the danger is open and obvious without any warning devices, and the city cannot relieve itself of this duty by turning the work over to the contractor.

LIABILITY FOR DAMAGES CAUSED BY BROKEN MAIN

In an action against a city for damage to property from the breaking of a water main in the street in front of the premises, the Massachusetts Supreme Judicial Court holds, *Lyons v. City of Lowell*, 131 N. E. 860, that the city, in furnishing water to its inhabitants for its own profit, was engaged in an undertaking commercial in character and was liable for its negligent acts. As the city was found by the auditor to have been negligent, and as his findings, by the agreement of the parties to the action, were final, judgment was held properly entered for the plaintiffs. Even if the defendant was careful in the inspection and testing of its water pipes and mains, the fault as found by the auditor was in the original construction—that if proper care had been used when the pipes were laid the break would not have occurred.

NEWS OF THE SOCIETIES

Oct. 31—METROPOLITAN SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Get-together fall meeting. New York City.

Oct. 31-Nov. 5—NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Power show in connection with INTERNATIONAL TEXTILE EXPOSITION. Mechanics' Building, Boston, Mass. Secretary, James F. Morgan, Devonshire st., Boston.

Nov. 1—CLEVELAND SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Hotel Winton. Secretary, Charles H. Day, Illuminating Co.

Nov. 1—VIRGINIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Fall rally meeting. Secretary, Charles Loeber, R. M. Anderson Co., Richmond.

Nov. 1-4—INDUSTRIAL RELATIONS ASSOCIATIONS OF AMERICA. Waldorf-Astoria Hotel, New York City.

Nov. 2—BUFFALO SECTION AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Lafayette Hotel. Secretary, F. B. Hubbard, 146 Arkansas st.

Nov. 2—CENTRAL PENNSYLVANIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Williamsport, Pa. Secretary, Prof. P. P. Henschell, Penn. State College.

Nov. 3—HARTFORD BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Bond Hotel. Secretary, W. D. Halsey, Hartford Steam Boiler Inspection and Insurance Co.

Nov. 4—MINNESOTA SECTION, AMERICAN WATER WORKS ASSOCIATION. Minneapolis, Minn., Secretary, H. A. Whittaker.

Nov. 8—WATERBURY BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Chamber of Commerce Hall. Secretary, J. R. Putnam, 64 Woodside ave.

Nov. 9—BALTIMORE SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Engineers' Club. Secretary, Prof. A. G. Christie, Johns Hopkins University.

Nov. 13-17—AMERICAN CIVIC ASSOCIATION. Chicago, Ill. Headquarters, 905-7 Union Trust bldg., Washington, D. C.

Nov. 14—METROPOLITAN SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with A. I. E. E., A. I. M. E. and A. S. C. E.

Nov. 14—NEW HAVEN BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Mason Laboratory, Yale University. Secretary, Prof. S. W. Dudley, 400 Temple st., New Haven.

Nov. 14—NEW YORK SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Engineering Societies bldg., New York City. Sec., G. I. Rhoads, 115 Broadway, New York City.

Nov. 14-16—CITY MANAGERS' ASSOCIATION. Annual meeting. Chicago. Secretary, H. G. Otis, city mgr., Clarksburg, W. Va.

Nov. 14-18—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

Nov. 15-18—ATLANTIC DEEP WATERWAYS ASSOCIATION. Savannah, Ga. Headquarters, Real Estate Trust bldg., Philadelphia, Pa.

Nov. 16-18—NATIONAL MUNICIPAL LEAGUE. Chicago. Secretary, H. W. Dodd, 261 Broadway, New York City.

Nov. 17—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Joint meeting with Society of Naval Architects and Marine Engineers. New York.

Nov. 17-18—SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS. New York.

Nov. 17—BRIDGEPORT BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Chamber of Commerce.

Nov. 17—TOLEDO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Toledo Commerce Club. Secretary, Loring Freed, Atlas Chemical Co.

Nov. 17—WORCESTER SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with Worcester section, A. I. E. E. Secretary,

Harry M. Latham, Crompton & Knowles Loom Works.

Nov. 21—CHICAGO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with Western Engineering Society.

Nov. 22—ATLANTA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Nov. 22—PHILADELPHIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Adelphia Hotel.

Nov. 25—COLORADO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Metropole Hotel, Denver. Secretary, William Lester, Vulcan Iron Works.

Nov. 28-29—KANSAS CITY SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Two-day regional meeting. Secretary, Louis Bendit, 517 Finance bldg.

Dec. 1-3—MONTANA IRRIGATION AND DRAINAGE INSTITUTE. Great Falls, Mont.

Dec. 6-9—AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. 14th annual meeting. Baltimore, Md.

Dec. 22-23—KANSAS ENGINEERING SOCIETY. Hutchinson, Kan.

Jan. 17-20—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual Convention and good roads show. Chicago, Ill.

May 15-19—AMERICAN WATER WORKS ASSOCIATION. Annual convention. Philadelphia, Pa.

CITY PAVING CONFERENCE

About 150 engineers and others were present, Oct. 20 and 21, at a meeting held under the auspices of the Engineers' Club of Philadelphia with the co-operation of the Society of Municipal Engineers, Philadelphia Section; Department of Public Works, Bureaus of Highways and Surveys of Philadelphia; Civil Engineering Department, University of Pennsylvania; Philadelphia Chamber of Commerce; City of Baltimore Paving Commission; Department of Public Works, Borough of Manhattan, City of New York; Advisory Board on Highway Research, Washington, D. C.

The program included the following papers, some of which were discussed on the floor: "The Structural Design of Pavements, Including Sub-base, Considerations and Economic Depth of Foundations," by A. T. Goldbeck, Engineer of Tests, Bureau of Public Roads, Washington, D. C.

"Preparatory Steps: Extension and Repairs of Surface and Sub-surface Structures," by R. A. MacGregor, Engineer, Department Public Works, Manhattan, New York City.

"Factors Determining Selection of Type," by C. M. Pinckney, Chief Engineer, Dept. Public Works, Manhattan, New York City.

"Relation of City Planning and Zoning to the Selection of Type of Pavement," by Jefferson G. Grinnalds, Secretary, Zoning Commission, Baltimore, Maryland.

"Recent Developments and Recommended Changes in Practice."

"Vitrified Brick," by P. C. Painter, City Manager, Greensboro, N. C.

"Wood Block," by Ellis R. Dutton, Minneapolis, Minn.

"Concrete," by B. H. Wait, Consulting Engineer, New York City.

"Hydrated Lime in Paving Concrete,"

by Tyrrell B. Shertzer, Construction Engineer, New York City.

"Granite Block" by C. D. Pollock, Consulting Engineer, New York City.

"Asphalt Pavements," by Julius Adler, Philadelphia Pa.

"Design of Bituminous Mixtures," by F. S. Besson, Major Corps of Engineers, U. S. Army, Asst. to Engineer Commissioner, Washington, D. C.

"Native Lake Asphalts and Their Relation to City Paving," by J. S. Miller, Chief Chemist, Barber Asphalt Paving Co.

"Guarantees and Inspection." "Inspection a Remedy for Guarantees," by Prof. S. A. Stephenson, Jr., Associate Professor Civil Engineering, Rutgers College, New Brunswick, N. J.

"Paving Inspection from the Viewpoint of the Contractor," by Thomas S. Martin 3d, representing Associated General Contractors of America.

"When Is Repaving Justified?" by Geo. H. Norton, City Engineer, Buffalo, N. Y.

"Regulation of the Disturbance of Old Pavements," by Jacob Schmitt, Chief Engineer of Highways, Brooklyn, N. Y.

"Causes of Destruction of Pavements and Paving Materials," by Dr. Felix Kleeberg, Department of Public Works, Manhattan, New York City.

"Regulation of the Disturbance of Pavement," by Col. R. Keith Compton, Consulting Engineer, Bureau of Paving, Baltimore, Md.

"Repair and Maintenance Problems Affecting City Paving," by P. T. Sharpless, Manager General, Tarvia Department, The Barrett Co.

"Paving Between Tracks and Adjoining Rails: Proper Construction of Street Railway Tracks," by E. J. McIlraith, Engineer of Way, Phila. Rapid Transit Co.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The section meetings of the A. S. M. E. scheduled for October and November contain many features of interest. Chief among these are: 1. The Industrial Fuel Gases meeting of the Metropolitan section held in Newark, N. J., on October 24th, including an inspection trip through the Harrison works of the Crucible Steel Co., dinner at the Downtown Club, and a paper on "Clean Cold Producer Gas from Bituminous Coal," by C. F. Kaufman of the Crucible Steel Co. of America; (2) the two-day professional session of the Indianapolis section on October 28th and 29th, at which the following papers were presented: "Stopshok Wheels, Their Construction, Use and Results Obtained Therefrom," by B. F. Seymour; "Stellite Metal and Its Application to the Arts," by Elwood Haynes; "Steam as a Motive Power for Commercial Vehicles," by Fred Hamilton; and "Acid Resisting Alloys—Research Work Covering Non-ferrous Metals in Its Application to Their Acid Resisting Properties," by George A. Drysdale; (3) an address at the meet-

ing of the Buffalo section on November 2nd by Prof. Arthur M. Greene, Jr., on "Progress in Mechanical Engineering Research;" (4) one at the Virginia section meeting on November 1st on "The Engineer's Place in Industry;" (5) discussion of the subject "Railroad" at the November 9th meeting of the Baltimore section; (6) the joint conference of the New Haven branch with the New Haven Chamber of Commerce and local sections of engineering societies, which will be a symposium on the economics of the coal problem in Connecticut; (7) an address at the Toledo meeting on November 17th on the "Industrial Engineer in Business," by Clifton B. Reeves of the Willys Overland Company; (8) an address at the meeting of the Atlanta section on the 22nd on "Water Power Developments of the Southeast," by C. G. Adsit; (9) a talk at the Philadelphia section meeting on the same date by Commander H. C. Richardson, U. S. N., on "Experiences on the NC 3 During the Trans-Atlantic Fight;" (10) an address by William Lester of the Vulcan Iron Works on "Properties of Cast Iron and Gray Iron Foundry Methods," before the November 25th meeting of the Colorado section; and (11) the two-day regional meeting of the Kansas City section to be held November 28th and 29th, at which will be discussed "Machinery Methods and Difficulties of Drilling," by R. D. Bush of the Empire Company, El Dorado, Kan.; Ross M. Stuntz, general superintendent of construction, Empire companies, and C. P. Demit and A. L. Bramer of the Gypsy Oil Co. of Tulsa, Okla., "Transportation of Oil by Pipe Lines," by S. B. Severson of the Empire companies, and the oil supply of the world by Mr. Ambrose of the Bureau of Mines, Washington, D. C.

The following section meetings are scheduled for the immediate future: Metropolitan branch, subject, "Engineering Financing;" Bridgeport branch, subject, "Relation of Engineering and Management," discussed by Walter Rautenstrauch of the J. G. White Management Corp., N. Y. C.; Columbus section, at which meeting the section will be hosts of the Associated Columbus Engineering Societies; Atlanta section, get-together dinner; and the Philadelphia section, subject "Public Utilities," address by W. C. L. Eglin of the Philadelphia Electric Co.

AMERICAN SOCIETY FOR STEEL TREATING

A course of lectures has been planned by the American Society for Steel Treating, together with Engineering and Architectural Societies of Minnesota.

These lectures, nine in all, will cover the following subjects:

- Composition, Elements and Classification of Steel.
- Instruments and Apparatus.
- Constitutional Diagrams.
- Cast Iron, Malleable Iron and Cost Steel.
- Forgings.
- Annealing and Hardening.
- Drawing and Inspecting.
- Alloy Steels.
- Tools and Die Steels.

A fee of \$1.00 will be charged those enrolling for the course which will cover the entire expense.

For full information address Alexis Caswell, 200 Builders Exchange, Minneapolis.

ENGINEERS' SOCIETY OF ST. PAUL

A regular meeting of the Engineers' Society of St. Paul was held October 10. J. P. Kyle, attorney, spoke on "The Proposed City Charter."

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The October meeting of the Minnesota Section of the American Institute of Electrical Engineers was held October 24th at the State University. W. F. G. Swann, professor of physics, University of Minnesota, spoke on the "Theory of Relativity."

JOINT MEETING OF NATIONAL ENGINEERING SOCIETIES

One of the biggest engineering gatherings of the year will be a public meeting on the subject of the St. Lawrence Ship Canal and Power Project to be held in New York City on Monday, November 14. W. L. Saunders is chairman of the committee making elaborate preparations for this event, which is one of a series of joint meetings arranged by the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

Governor Henry J. Allen of Kansas will be one of the speakers. He will discuss the project from the standpoint of the producer of the Middle West. Dr. R. S. McElwee, former Director of the Bureau of Foreign and Domestic Commerce, now Director of the School of Foreign Service, Georgetown University, Washington, D. C., will speak on "The Greatest Single Step along the Road to National Efficiency." Dr. MacElwee will illustrate his talk and will go into the economic features of the project.

H. I. Harriman of Boston will discuss "The Power and Transportation Features of the Project, Translated into the Economics of New England and the East." Definite acceptances have been received from these speakers. Ex-Governor W. L. Harding of Iowa is also expected to deliver an address. Herbert Hoover has been invited to preside.

BROOKLYN ENGINEERS' CLUB

At the regular meeting, October 13th, a paper entitled "Art of Illustration in the Promotion and Publicity of the Ideas, Inventions and Work of Technical Men," and illustrated by lantern slides, was presented by Mr. H. P. Quick, consulting engineer.

DINNER TO JOHN FRITZ MEDAL DEPUTATION

A dinner was given in New York, October 10th, by the American Society of Mechanical Engineers to the deputation, which conferred the John Fritz Medal on Sir Robert Hadfield and Eugene Schneider, which was participated in by a large number of members and guests who listened to a number of interesting addresses in some of which the International Peace Aspect was discussed.

INDUSTRIAL NOTES

Teran-Lange, Inc., contractors, has recently been organized to engage in the installation of power, heating and ventilating plants, with offices in the Grand Central Terminal, New York City.

The Standard Sand and Gravel Co. has been incorporated at Kewance, Wis., by George Shackett, I. J. Fiddler and Charles L. Peterka of that city.

The Pittman-Smith Engineering Co., Pittsburg, Pa., has recently been organized by E. W. Pittman and H. P. Smith, general manager and chief engineer respectively for the engineering works department of the Dravo Contracting Co., to engage in the design of power plants, machinery layouts and all types of industrial buildings.

CLEVELAND BUILDING EXPOSITION

Cleveland will offer something new in the way of a building exposition opening the new \$5,000,000 municipal auditorium January 4 to 14, inclusive. It is sponsored by the Builders Exchange, the largest organization of the kind in the United States, and will be on a non-profit basis. Earnings are to be rebated to the exhibitors, pro rata, according to space they bought.

Nearly six years ago Cleveland material men put on a most successful exclusive building material and equipment show, introducing the rebate idea.

The convention hall and the main exhibition floor will both be used. Already approximately 60 per cent of the space has been sold.

Exterior structural materials, real estate, financing and architecture will dominate the convention or arena floor. Here will be built perhaps a dozen completed cottages and bungalows. On the main exhibition floor will be shown everything that goes inside the building, decorating, finishing, furnishing and equipment, while a section will be set aside for contractors' machinery and equipment.

The lumber interests have engaged a \$10,000 space, while two individual brick exhibits will occupy spaces that each cost in excess of \$6,000.

Adding to the national interest The Associated General Contractors will hold their annual convention in Cleveland during exposition week, as also will the National Federation of Construction Industries, while the annual convention of the Ohio Association of Builders Exchanges is scheduled for the last three days. Effort is being made to increase the convention list.

The sole object of the exposition is to stimulate building interest for the coming spring. Last year Cleveland's building investment was a trifle more than \$78,000,000. In the Fourth Federal Reserve district, of which Cleveland is the financial center, the building investment was approximately \$480,000,000. And there are nearly 100,000 vacant building lots in the hands of prospective builders in Greater Cleveland today, according to the county auditor.

Ralph P. Stoddard, who had charge of the 1916 show, is Director General of the exposition, and Richard G. Collier, who was associated with him then, is assistant manager.

Automatic Gas Making for Towns and Isolated Consumers

In many cases where it is expensive, inconvenient or causes much delay or the installation of costly plant and equipment to provide ordinary coal gas for illumination, heating and cooking purposes, it has been found advantageous to install machines producing gas from gasoline, a high grade naptha which evaporates in the open air. The process of producing the gas is simple, but as the gasoline evaporates irregularly, the air, which is the vehicle by which it is delivered to the burners, contains varying amounts of the gas, which is likely to cause smoke and make it difficult to regulate the flame satisfactorily.

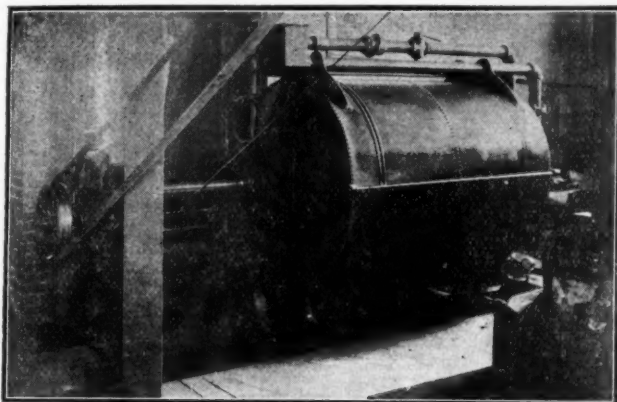
stitutions, shops, factories, laboratories and in educational buildings. The only expense involved is the first cost of installation and the cost of the gasoline, which at the present price of about 25c. per gallon is equal to about \$1.00 per thousand cubic feet of gas.

This gas is much hotter than ordinary city gas (coal gas) or acetylene gas. One thousand cubic feet of it will maintain an 80-candle power burner, equipped with a mantle, for 400 hours at a cost of $\frac{1}{4}$ of one cent or less per hour.

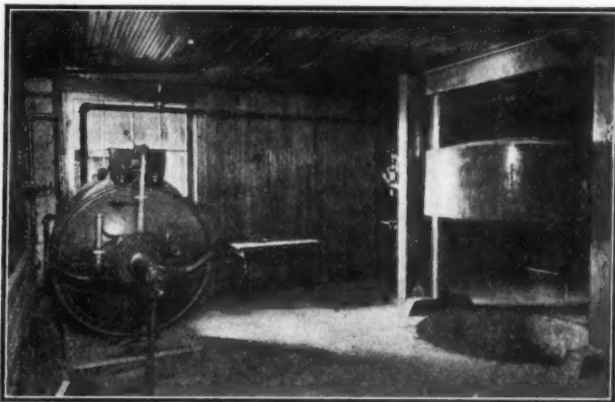
It is claimed to be superior to acetylene gas because of its freedom from explosion, to which the latter is sub-

machine, suitable for institution or community use, weighs about 11,000 pounds and can be installed by two men with ordinary gas fitters' tools in about two weeks. The smaller size machine requires no special conditions or foundations, but the larger ones should be placed on a concrete base. Wherever electric power is available the hand-wound weight that is ordinarily furnished to operate the air pressure device can be advantageously replaced by a small electric motor.

The numerous installations of the Tirrill gas machine include 9 colleges and universities having from 1 to 8 machines each; 8 laboratories, equipped



MACHINE WITH CAPACITY OF 120,000 FEET IN 24 HOURS
INSTALLED IN CHEMISTRY BUILDING,
PENNSYLVANIA COLLEGE



500,000-FOOT MACHINE INSTALLED IN MINING
BUILDING, PENNSYLVANIA COLLEGE.
AIR PUMP DRIVEN BY WEIGHT.

There was designed several years ago a machine producing gas by evaporation of gasoline at normal temperatures and provided with a special apparatus for delivering variable fixed quantities of gas and pure air to a mixing chamber where an absolutely regular quality of gas of any desired degree of richness can be maintained under uniform pressure and transmitted to the burners.

The machine consists essentially of a carburetor in which the gasoline is volatilized, a mixing chamber by which the required richness of gas is accurately maintained, and a meter or air pump, usually operated by a weight, that provides the air pressure for mixing and delivering the gas and is equipped with a special valve and regulating mechanism essential to the improved features of the machine.

The whole apparatus is small, compact, free from complicated parts or liability to breakage or derangement. It can be installed rapidly by ordinary workmen in any convenient location and will, when properly assembled and adjusted, work automatically without attendants, providing a constant supply of a uniform quality of gas at a uniform pressure and requiring no other attendance than that necessary to occasionally replenish the gasoline supply and wind up the weight.

These machines, called Tirrill Equalizing Gas Machines, have been installed and successfully used in many places for lighting, cooking, heating and power for residences, villages, in-

ject, and because it only costs about one-fifth as much. Blau gas or Pintch gas costs from one to three times as much as Tirrill gas and is delivered in bottles which are inconvenient and sometimes dangerous to handle and transport.

When used for cooking, Tirrill gas costs no more than coal and eliminates the cost of kindling wood, labor to build fires, labor for removing ashes, extra space required for the coal apparatus, labor of cleaning chimney, increased insurance rates and increased cost of renewing cooking utensils, which together with the greater convenience and the consumption of the gas only when in actual service makes it very desirable for domestic purposes.

When equipped with a Tirrill Blast Flame heating burner, the gas will produce a temperature of 2,000 degrees, which is instantly adjustable for laboratory or mechanical purposes.

When the gas is passed through a Tirrill combination mixing valve it can be regulated to produce and maintain the required temperatures for hot plates, stills, sterilizers, autoclaves, warming closets, blast furnaces, gas fuel heating appliances, ovens, water heaters and ranges.

The machines are made in eight sizes with rated capacities of from 25 to 1,500 lights. The complete equipment, suitable for a small residence, weighs about 1,000 pounds and can be installed by one man in a few days. The largest

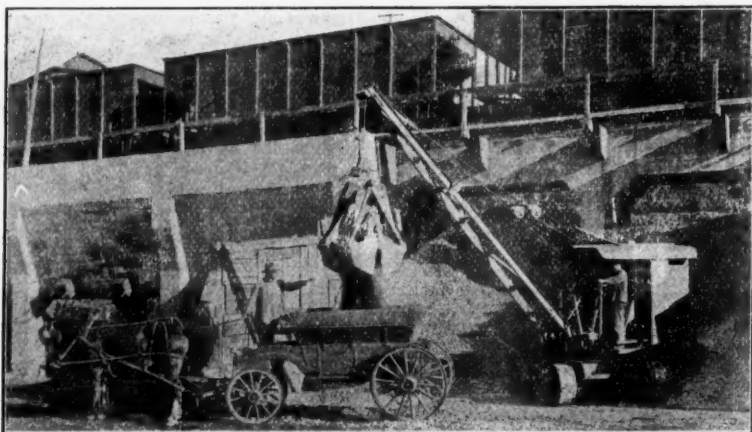
with 1 to 6 machines each; 5 factories with 2 to 9 machines each; 4 shops with 1 to 6 machines each; 6 large hospitals and other institutions with from 1 to 7 machines each; villages and towns, and a large number of private residences having one or more machines with capacities up to 27,000 cubic feet daily. In the Pennsylvania State College, where 8 machines have been successfully installed, it is claimed that the abundant and economical use of the gas for heating and laboratory purposes has been an important factor in the steady growth of the institution from the time the first machine was installed to the present total of 4,572.

The largest machine manufactured is suitable for village supply and has a capacity sufficient to supply illumination and cooking heat for 250 average families, which would then be enabled to save several tons of coal each year by its use.

With the present price of gasoline, considerable advantage is claimed for the installation of these machines in small villages, where the cost of attendance, labor, operation, and supervision can be entirely eliminated by its use. Desirable results can be obtained in many instances where a distribution system installed for natural gas is available and, the natural gas supply having become greatly diminished, it is necessary to provide an artificial gas, which can be much more quickly and easily derived from gasoline than by the construction of a coal gas producing plant.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



A FAST, FLEXIBLE CRANE ON A STEEL WHEEL CHASSIS

A FAST, FLEXIBLE AND PORTABLE CRANE

The Universal Crane, built by the Universal Crane Co., was carefully designed by men of over 20 years experience with the idea of making it extremely flexible and absolutely dependable, and was thoroughly tried out before being put on the market. Its weight has been safely reduced to the point where it can be mounted on motor trucks and rubber tired trailers so that it can be moved quickly from place to place.

The crane is built as a standard unit and can also be mounted on a wide wheel chassis for work on the ground or on standard gage track, or it can be mounted on continuous tread, on a low wheeled traveling carriage that runs on rails laced together and laid on a railroad flat car, on a portal pier, ground foundation, or barge, and can be transferred from one mounting to another or made to dismount itself under its own power.

Power is furnished by a heavy duty, 4-cylinder, gasoline engine which has

been selected for its freedom from vibration and heavy, dependable construction. Electric motor drive can be furnished when required.

The crane is a compact, full-revolving type that requires but little room for storage or to operate in. The rear swinging clearance is only 7½ instead of 9 or 10 feet as is usually the case, and the flat car mounting is arranged so the crane body can be shifted sideways, one foot in either direction, on the axles where it locks so the crane can rotate within 6½ feet from track center.

The crane handles a clam-shell bucket, electric lifting magnet, or hoist block. An electric generator can be added, when necessary, and driven by the crane motor to excite the magnet.

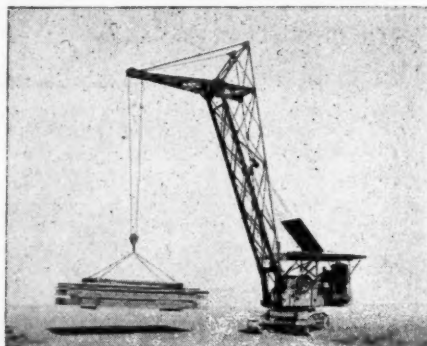
The capacity is 3 to 4 tons and the operating speeds are so high that it can turn out in a day practically the same volume of work as many much larger cranes do, having unloaded 41-yard cars of sand in 28 minutes, and others in around 37 minutes apiece. Stone has been placed in trucks from storage in

the quantity of 200 tons in under four hours. Three hundred tons of coal have been taken from railroad cars and placed in trucks in a 9-hour day.

Only one man is required for operation, and he need not be a licensed engineer. The steel wheel chassis and continuous tread types are travelled and steered by power from the operator's platform, and the rubber tired trailer mounting is equipped with a similar travel gear. With the gasoline engine no fuel need be consumed when crane is idle and this machine only uses 10 to 15 gallons a day under normal working conditions.

GOOSE-NECK BOOM ON P & H CRANE

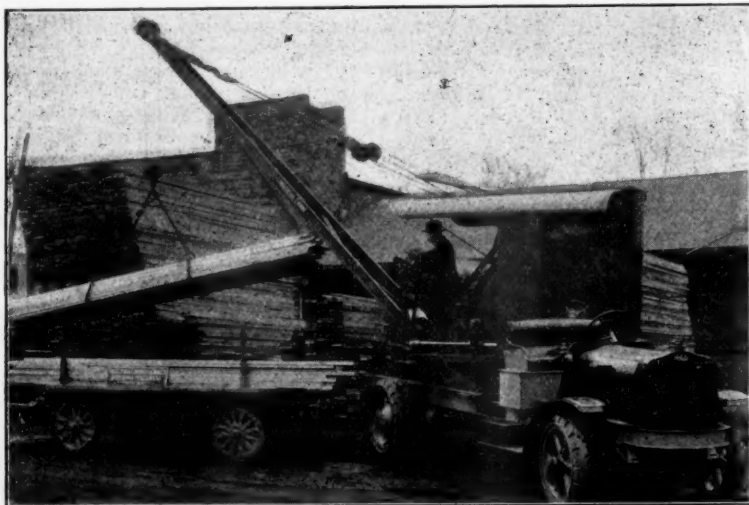
In adapting a P & H 206 Crane of the type shown in the accompanying illustration, to the handling of loads such as unit packages of lumber from high piles, it was found that the lengths of lumber interfered with the standard crane boom. To overcome this and eliminate much of the costly labor required to handle lengths of lumber, pipe, etc., the mak-



P & H GASOLINE DRIVEN CRANE WITH GOOSE NECK BOOM HANDLING 6x18-FOOT 3-TON PACKAGE

ers, Pawling & Harnischfeger Co., developed the Goose-Neck boom, which may be lifted almost straight up without having the load interfere. In other respects this boom is like the standard design and attaches to the gasoline-driven corduroy-traction machine in a similar manner.

The first plant using the Goose-Neck boom on a P & H "206" operated it for handling lumber in aisle-ways 18 feet wide, taking lumber in unit packages off 2-foot piles and placing on wagons or trailers spotted in the aisle-ways. Hardwood at 4 pounds per square foot was handled at the rate of 1500 square feet per trip. The amount handled per day varied and was limited by the auxiliary equipment—trucks, wagons, trailers—required to carry the lumber to stock, or to the cut-up room or for delivery as the case might be. The company using this "206" crane with new Goose-Neck boom will require only 10 laborers instead of 25 previously used, making a labor saving of \$60 per day.



A FAST AND FLEXIBLE CRANE ON A WHITE TRUCK